

Analysis of Electron Energy Distribution Function in the LINAC4 H-Source

S. Mochizuki¹, S. Mattei², K. Nishida¹, A. Hatayama¹ and Jacques Lettry²

¹*Faculty of Science and Technology, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama 223-8522, Japan*

²*CERN, 1211 Geneva 23, Switzerland*

Corresponding Author: S. Mochizuki, e-mail address: mochizuki@ppl.appi.keio.ac.jp

A numerical simulation code based on the Electromagnetic Particle in Cell (EM-PIC) Model with Monte Carlo method for Collision processes (MCC) has been developed to understand the Radio Frequency Inductively Coupled Plasmas (RF-ICP) [1]. It is possible for the code to obtain the Electron Energy Distribution Function (EEDF) and Ion Energy Distribution Function (IEDF) in RF-ICP. This is the most distinct feature of the code compared with the conventional fluid model.

The code has been improved step-by-step by including various effects, such as i) capacitive component of the electric field[2], ii) Coulomb collision[3] and iii) coupling to the Collisional Radiative (CR) model[4,5] for the calculation of Balmer emission lines from the source plasmas. The code has already been applied to the simulation of the Linac4 H- source plasma. Most of these studies, however, were focused on the macroscopic property of RF plasmas and detailed discussion of the EEDF in RF plasmas has not been given so far.

In this paper, with the RF-code described above, we mainly discuss the characteristic features of the EEDF in RF plasmas. The relationship between the EEDF and plasma source parameters (magnitude of RF field, RF-coil current, etc.) will be investigated. Also, the numerical results of the EEDF in RF plasmas have been compared with those by simple theoretical approach [6] based on the Boltzmann equation.

References

- [1] S. Yoshinari, T. Hayami, R. Terasaki, A. Hatayama and A. Fukano, Rev. Sci. Instrum. 81, 02A728 (2010)
- [2] S. Mattei, M. Ohta, M. Yasumoto, A. Hatayama, J. Lettry and A. Grudiev, Rev. Sci. Instrum. 85, 02B115 (2014)
- [3] S. Mochizuki, S. Mattei, T. Shibata, K. Nishida, A. Hatayama and J. Lettry, AIP Conf. Proc. 1655, 020016 (2015)
- [4] T. Yamamoto, T. Shibata, M. Ohta, M. Yasumoto, K. Nishida, A. Hatayama, S. Mattei, J. Lettry, K. Sawada and U. Fantz, Rev. Sci. Instrum, 85, 02B118 (2014)
- [5] T. Shibata, S. Mattei, K. Nishida, A. Hatayama and J. Lettry, AIP Conf. Proc. 1655, 020008 (2015)
- [6] V. E. Golant, A. Zhilinskii, S. A. Sakhavov, Fundamentals of Plasma Physics, (Wiley, New York, 1977)